

## THE DEVELOPMENT AND EXTENSION OF NONCHEMICAL CONTROL TECHNIQUES FOR STORED COWPEAS IN NIGERIA

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**INTRODUCTION:** Nigeria produces about a million tonnes of cowpeas each year. They are grown by peasant farmers as one component of a mixed crop. Yields are about 200 kg/ha although if they are grown as a sole crop yields of over 1,000 kg/ha can be obtained if the crop is protected from pest attack. About 80% of the crop is grown in the dry savanna areas of the north and probably about 80% is planted after the beginning of the wet season in July and harvested soon after the rains end in October.

Soon after harvest about 4% of the seeds offered for sale show the typical emergence holes made by bruchid beetles. This figure rises steadily through the season until between 60 and 70% of the seeds have emergence holes. A relationship can be established between percentage damaged grains and percentage loss of substance. When 10% seeds are damaged about 1.5% of the substance has been lost. When 70% are damaged there will be a loss of about 20% of the substance. Using this relationship it can be shown that about 32,000 tonnes are lost in storage every year through insect attack. [1]

The main insects causing the damage to seeds in the savanna region are as follows:

*Malanagromyza vignalis* Spencer - A small fly which attacks the green pods and never survives into storage. It is probably responsible for less than 0.1% of the total damage.

*Piezotrachelus varius* Wagn. - A weevil which comes later than the fly, may just survive into storage but does not continue. The loss caused by it is little more than that caused by the fly.

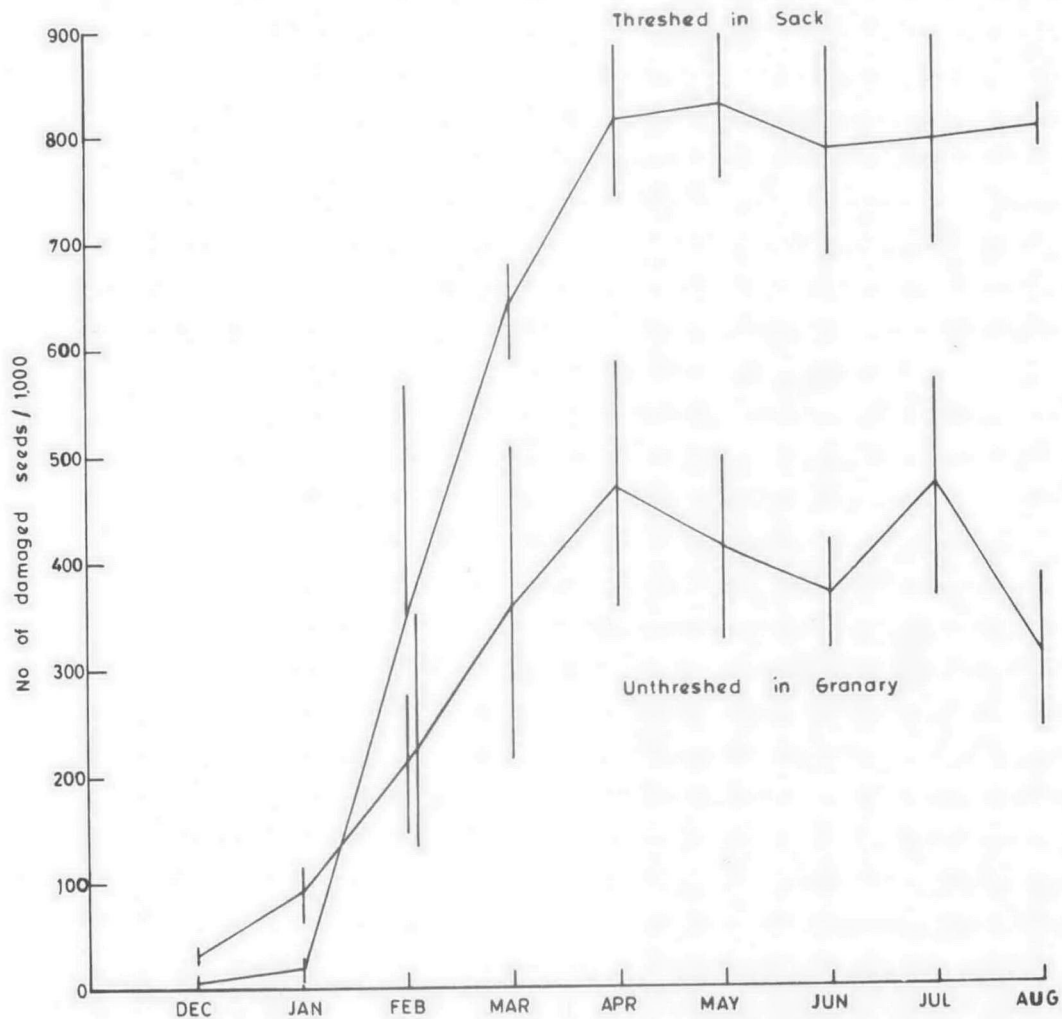
*Bruchidius atrolineatus* Pc. - A bruchid which attacks the ripening pods and does continue into storage. It does not do well in storage but is responsible for much of the damage which occurs during the first weeks of storage.

*Callosobruchus maculatus* Fab. - A bruchid which begins its attack in the field, continues in storage and is the main cause of loss of stored cowpea in Nigeria.

After harvest the seeds are stored in the pod in mud granaries which may hold 50 to 500 kg of seed and pod. This is threshed as the farmer wants it either to eat or to sell.

The crop is carried in sacks which hold about 100 kg and finally sold to consumers by the "mudu" which is a volume measure weighing about 1 kg. The cost of a sack of cowpea after harvest in December 1973 was ₦26 (\$40) and by September 1974 it had risen to ₦44 (\$66).

**REDUCTION OF INSECT DAMAGE:** Using the pod - Cowpeas from the November 1972 harvest were either stored unthreshed in traditional type granaries or else threshed and stored in sacks. At setting up samples were taken and the number of seeds showing bruchid emergence holes were counted. Sacks and granaries were emptied at monthly intervals and the level of damage assessed each time. A summary of the results is given in Fig. 1. This shows that if stored in a sack the level of damage will rise to about 80% of the seeds and then remain constant, while if it is stored in pods in a traditional style granary the level of damage will be halved.



**FIGURE 1.** Development of damage to cowpea stored threshed in sacks or unthreshed in granaries. Vertical lines indicate standard error.

It is clear that the pod affords considerable protection and for the foreseeable future farmers are going to continue to store their cowpeas in the pod. It follows that if the protection afforded by the pod can be increased the damage done to the beans will be reduced. A preliminary assessment last year of some of the varieties

available showed that there seem to be differences. This year about 300 varieties are being grown and the pods will be subjected to a heavy challenge by *C. maculatus* to see if the differences noted last year are real.

No difficulty is likely to be experienced over extension as long as the breeders can put the desired seed into the resistant pod. In the past, work in this field has been concerned with the seeds and there is no doubt that certain types of seed coat are not liked by the beetles. They are not liked by the human consumers either and although high yielding they have not been accepted.

Multiple cropping - If we assume that the total amount produced is a million tonnes and that a twelfth is consumed each month then knowing what the average level of damage is for the month it is possible to calculate how much substance is lost each month. If there is one harvest in October then using the above model 57,250 tonnes will be lost in a year. If two-thirds of the total is harvested in October and the rest in July and if all the October harvest is consumed by July it can be shown that the total loss will be 39,150 tonnes, a saving of 32%. If now there are three harvests, one in October which amounts to 40% of the crop and further harvests in March and July each amounting to 30% of the crop it can be shown that the loss will now be 24,800 tonnes or a saving of 57%.

How feasible is this?

The February-March planting with a July harvest is done. In the far north of the country around the shores of Lake Chad a variety called Dan Borno is planted on the receding shores of the lake. It is a brown rough skinned variety which is much prized. North of Sokoto and Katsina a white rough skinned variety is planted on the receding shores of lakes and rivers in February and March and harvested in July. This is locally known as "Sokoto bean" which is also greatly sought after. Along the river Niger and Benue there are a number of other varieties grown at the same time but these are small smooth skinned, coloured varieties which are not much liked.

There are difficulties. The ordinary October harvested type is white rough-skinned which is the desirable type and is known as a "Farin wake" (white bean). It is susceptible to day length and will only flower when days are getting shorter. This has clearly been overcome because there are the three areas where there is a July harvest. There are other problems: It is believed that both Dan Borno and Sokoto are susceptible to disease. This may be true. We have had very heavy losses in the dry season through aphid born virus disease between Kano and Zaria. The main wet season pest, *Maruca testulalis* Geyer (Lepidoptera: Pyralidae) is absent and it may be that *Aphid craccivora* Koch is absent too in the far north or at least there is no virus reservoir. We have yet to find out. This might explain why the unpopular smooth, coloured varieties are grown along the Niger and Benue Rivers.

Irrigation schemes are multiplying and with each there is a lake with a receding margin. If a variety can be found which

combines the desirable qualities of rough white coat with virus tolerance or resistance there is not likely to be an extension problem. This could lead to a big expansion of the present planting in Sokoto and Borno and provide an acceptable variety for the Niger and Benue river areas.

During the months of November, December and January a cold dry wind called the Harmattan blows from the northeast. Mean minimum temperatures of 14 to 16°C and lowest minimum temperatures of 10 to 12°C are normal. Under these conditions cowpeas will not grow. If a variety could be found which would tolerate these conditions then cowpeas could be included among the crops which are planted under irrigation in November and December, so providing a third harvest period in March.

Hermetic storage - A number of people have investigated the possibilities of using hermetic storage as a means of controlling insect pests. The relevant work on cowpeas in Nigeria was done by O'Dowd [2] He investigated a number of different materials and showed that the bruchid was able to bore through all the plastic ones but not through butyl rubber. He also found that if a cheap cotton liner is placed within a plastic bag the beetles no longer bore through it.

He found that using butyl bags oxygen concentration fell to less than 1% in 20 to 30 hours and at the same time CO<sub>2</sub> content rose to 10%. This was found to be sufficient to kill all stages of the bruchids. Subsequently oxygen concentration rose to about 15% over the next five months and carbon dioxide fell to about 3.5% over the same period.

Butyl rubber was used supported by weld mesh to hold cowpeas in 10 tonnes and 500 kg units. It was very effective in controlling the beetles but the material deteriorated and cracked seriously

Black polyethylene was used in 500 kg and 50 kg units with cotton liners. The larger one again supported by weld mesh. These were found to be excellent. The bags were used for one year only but since they are relatively cheap this is not an impossible barrier to their use as it is with butyl.

The 50 kg bags cost about 50 kobo (\$0.75) and the cotton liner cost about the same amount. This is not high when it is considered that the beans the bag will contain are worth about ₦20 (\$30).

There are extension difficulties. It has already been stated that the farmer stores his cowpea in the shell in mud granaries. He is reluctant to thresh it at harvest because this is his busiest period and to do so would be a complete break with tradition. The method has not caught on with farmers although they are prepared to use bags if they are given to them. It is however becoming popular with the consumer who up to now was reluctant to buy cowpeas early in the season when they were cheap and of good quality because it is well known that they quickly deteriorate through beetle attack. Now consumers are beginning to realise that by using this method they can keep their beans in good condition

for as long as they like. They use 50 kg units. State ministries are becoming interested in the 500 kg units.

**SUMMARY AND DISCUSSION:** The pests of stored cowpeas are not easily controlled chemically at the farmers' level; indeed trials have shown that methods found to be successful for guineacorn can increase the loss of cowpeas. The shell provides considerable protection for the seeds within and a search is being made for a type of pod which gives an increase in this protection.

About 80% of the crop is planted in July or August and harvested in October. The falling stocks of seed become increasingly attacked by bruchid beetles. If the July harvested crop can be developed the October crop will be sold off by July and the overall loss will be reduced. This depends largely on finding a variety which can tolerate virus attack and still has those qualities required by the consumer. There seem to be good prospects of finding such a variety. It will be more difficult to find a cold tolerant variety which can be planted in November under harmattan conditions on the irrigation schemes. If one can be found it will further reduce the overall loss.

Hermetic storage in plastic bags with a cotton liner is very effective, but is not generally acceptable to farmers. It is however well liked by consumers because it enables them to buy good seeds when the price is low and then maintain the quality.

#### REFERENCES:

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- [2] O'Dowd, E. T. Hermetic storage of cowpea (*Vigna unguiculata* Walp.) in small granaries, silos and pits in northern Nigeria, Samaru Misc. Paper 31 (1971).